EXECUTIVE SUMMARY

PREPARED FOR:

LEWIS & CLARK COUNTY

HIGH HAZARD LOCATION TRAFFIC STUDY

PREPARED BY:

CHRISTIAN SPRING SIELBACH & ASSOCIATES

BILLINGS MONTANA

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TRAFFIC STUDY

FOR

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2020 GRAND AVENUE

BILLINGS, MONTANA

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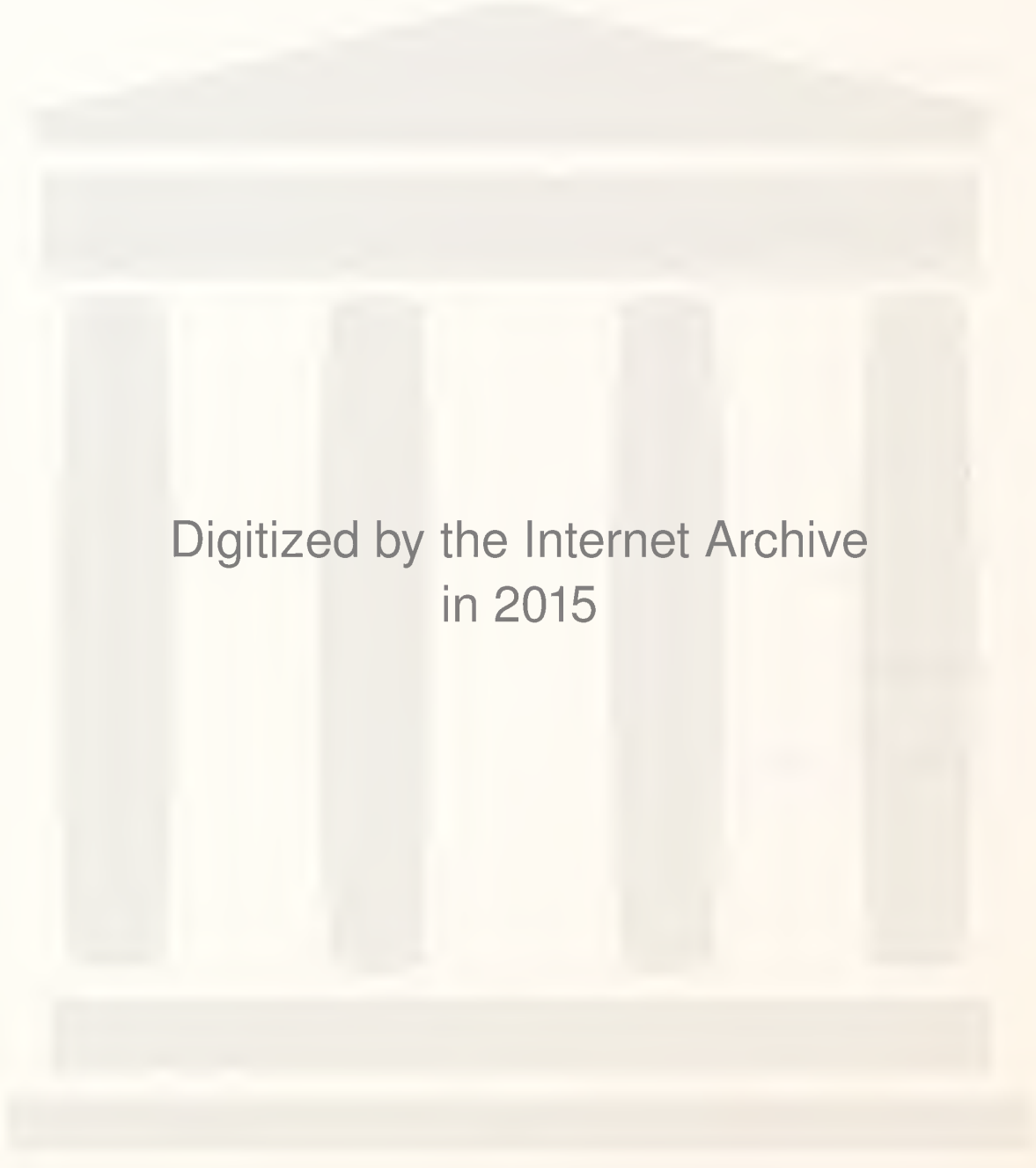

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INTRODUCTION

Lewis and Clark County had embarked on a project to eliminate or alleviate existing problems at high hazard accident locations. With the preliminary technical and organizational assistance of the Department of Community Affairs, Highway Traffic Safety Division, eighteen sites were selected for study. The basic intent of this study was twofold.

1. The study analyzed each site in relation to the degree of hazardness and established a priority ranking for improvement projects based on the composite hazard ranking and cost-benefit ratios.
2. The study presents recommended improvements and provides a vehicle for Lewis and Clark County to continue the program in the future.

The analysis of hazard location was based primarily on Report No. FHWA-RD-77-83 "Identification of Hazardous Locations" as refined by DCA Project No. 79-04-01-01. Modifications to these reports were made after intensive testing and error analysis. The methodology used to establish priority rankings was tailored to Lewis and Clark County's requirements and provides for flexibility in the analysis of county road system characteristics.

This report briefly presents the method of study and the results of the analysis along with recommendations for priority improvements and program continuation by Lewis and Clark County. Details of methodology, improvements and other aspects of the study can be found in the main report.

STUDY METHODOLOGY

BASIC STUDY OUTLINE

The study was segregated into three distinct phases which best achieved the purpose and scope of the traffic study. These phases are outlined as follows:

Phase 1 - Data Collection Phase: includes the preliminary organization of the project including scheduling, form processing, field data collection and reduction of data. Accident data was obtained from reports filed at the Department of Highways. Traffic counts were taken at each location. The average daily traffic was determined by applying factors for seasonal and hourly variations.

Other data collected in the field included measurement of road widths and geometrics, an inventory of traffic control devices, turning movement counts and subjective observation of traffic operations.

Phase 2 - Analysis of Data: included the determination of hazard indices for each location by using the Federal Highway Administration Report No. FHWA-RD-77-83 "Identification of Hazardous Locations" and DCA Project No. 79-04-01-01 report. Computations involved with accidents, volumes, capacities, indicator values and other aspects of hazard indices were performed. From these computations a preliminary hazard ranking list was assembled. At this point a review with County personnel was made to discuss the project progress and significance of the preliminary ranking.

Phase 3 - Evaluation of Corrective Measures and Priority Listing: included the determination of improvements that would reduce or eliminate certain types

of hazards or hazards in general at the accident locations. Preliminary designs of those improvements included signing, geometric changes, channelization and reconstruction. The improvements were based on short term improvements and in some cases long term improvements.

Cost effectiveness calculations of the improvements at each location were determined by preparing preliminary cost estimates and computing economic benefits to arrive at a cost-benefit ratio. The composite hazard index ranking and cost-benefit ratio determined the final priority listing.

COST-BENEFIT RATIOS

Costs - are developed by preliminary estimation of required quantities based on current prices as tabulated from average bid prices of similar projects. The costs should in no way be considered a quote or final estimate of actual work.

Even though Lewis and Clark County maintenance crews are capable of performing the majority of the work, the costs are based on contract prices in order to correlate with costs requiring contract bid letting. The costs also do not include administrative, preliminary design details or field layout which occur in some short term improvements. Engineering and construction management costs are applied to long term improvements which generally require contract plans and specifications.

Benefits - are estimated by applying accident reduction forecasts based on the type of improvement recommended. The source of these forecasts is Roy Jorgenson and Associates, "Evaluation of Criteria for Safety Improvements on the Highway" (Washington, D.C.: U.S. Bureau of Public Roads, Office of Highway Safety, 1966), p. 316.

Various improvements at junctions, sections, curves, bridges, etc. are related to a fractional reduction of all accidents. Since many of the improvements may be found in various categories, engineering judgement is required to determine the major reductions. No combinations of improvements can exceed a 100% reduction in accidents.

The basic formula used to compute in this report is:

(% Reduction) x (Accident Rate) x (Useful Life of Improvement)
x (Average Severity in Dollars)

Where:	% Reduction	= Fractional Reduction of All Accidents
	Accident Rate	= Number of Accidents ÷ Number of Reporting Years
	Useful Life of Improvements	= 5 years for signing projects, 20 years for reconstruction
	Average Severity in Dollars	= Data Value of Accident Severity shown on Hazard Index Computation Sheet

If applied consistently the economic benefit computation will provide a realistic estimate of average economic savings to the general society. The benefit amount would not be interpreted as a dollar value that Lewis and Clark will receive as a result of dollar outlay. It is just a figure used to quantify the economic benefit to society if a certain number of accidents did not occur.

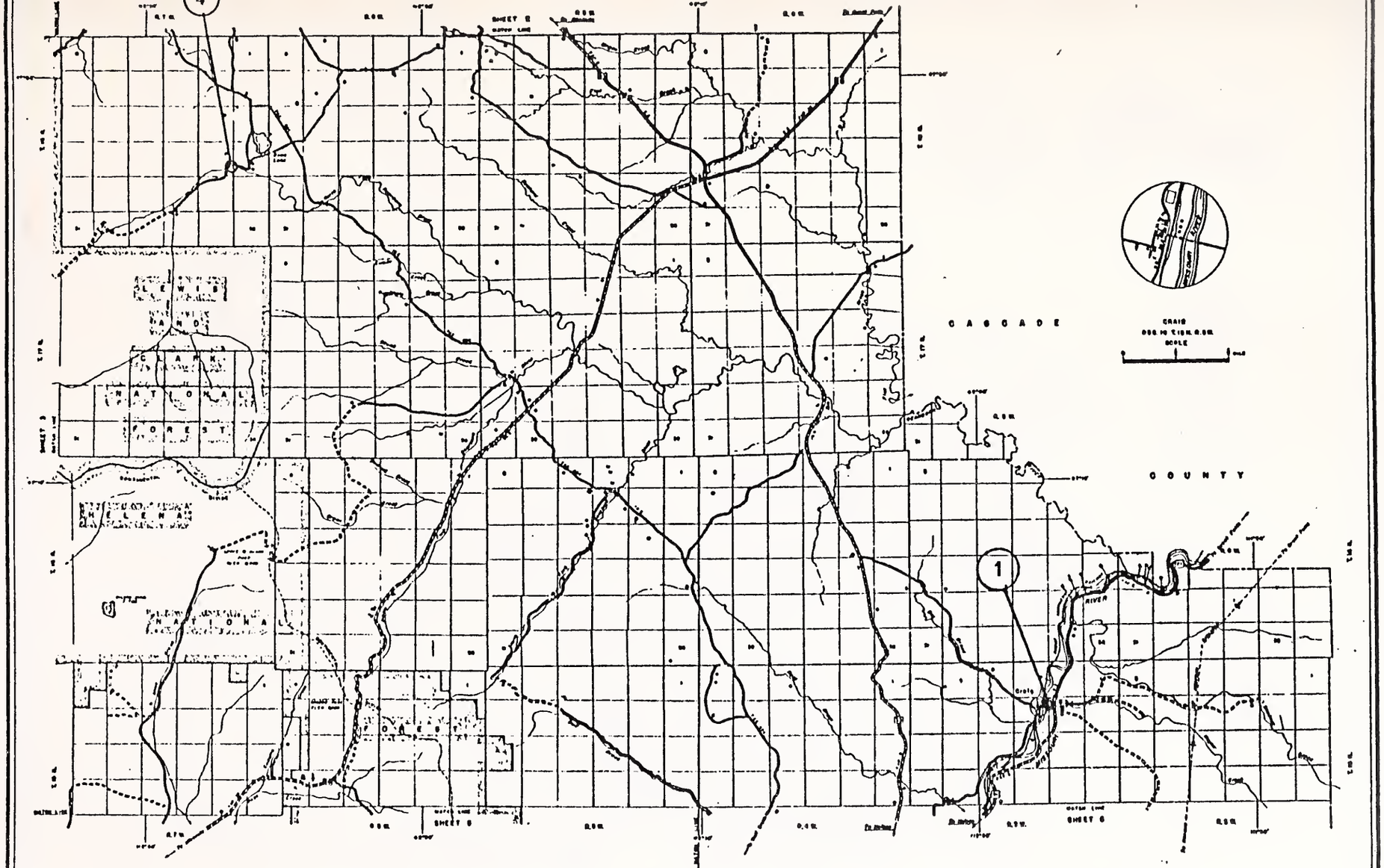
Ratio - of costs to benefits provides a reference as to the value of the recommended improvements. It is the desire of any improvement project to have a cost-benefit (C/B) ratio less than 1.0. If the C/B exceeds 1.0 the project is not justified. The value of a project is therefore inversely proportional to the value of the C/B.

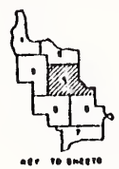
SITE LOCATIONS

The maps on the following pages indicate the site numbers at their respective locations.

Site Numbers

1 - Craig Access Road
2 - Holter Lake Road
3 - Country Club Drive
4 - Bean Lake Road
5 - Dry Gulch Road
6 - Colorado Gulch
7 - Greenmeadow Drive at Custer Avenue
8 - Greenmeadow Drive at Mill Road
9 - Greenmeadow Drive at Sierre Road
10 - Buffalo Road
11 - Herrin Road
12 - Canyon Ferry Road
13 - Nilan Reservoir Road
14 - Augusta (Broadway at Beech)
15 - York Road - Canyon Ferry Road
16 - Mill Road at Montana Avenue
17 - Motsiff Road at Montana Avenue
18 - McHugh Drive





KEY TO SHEETS

KEY TO COUNTIES

GENERAL HIGHWAY MAP
LEWIS & CLARK COUNTY
MONTANA

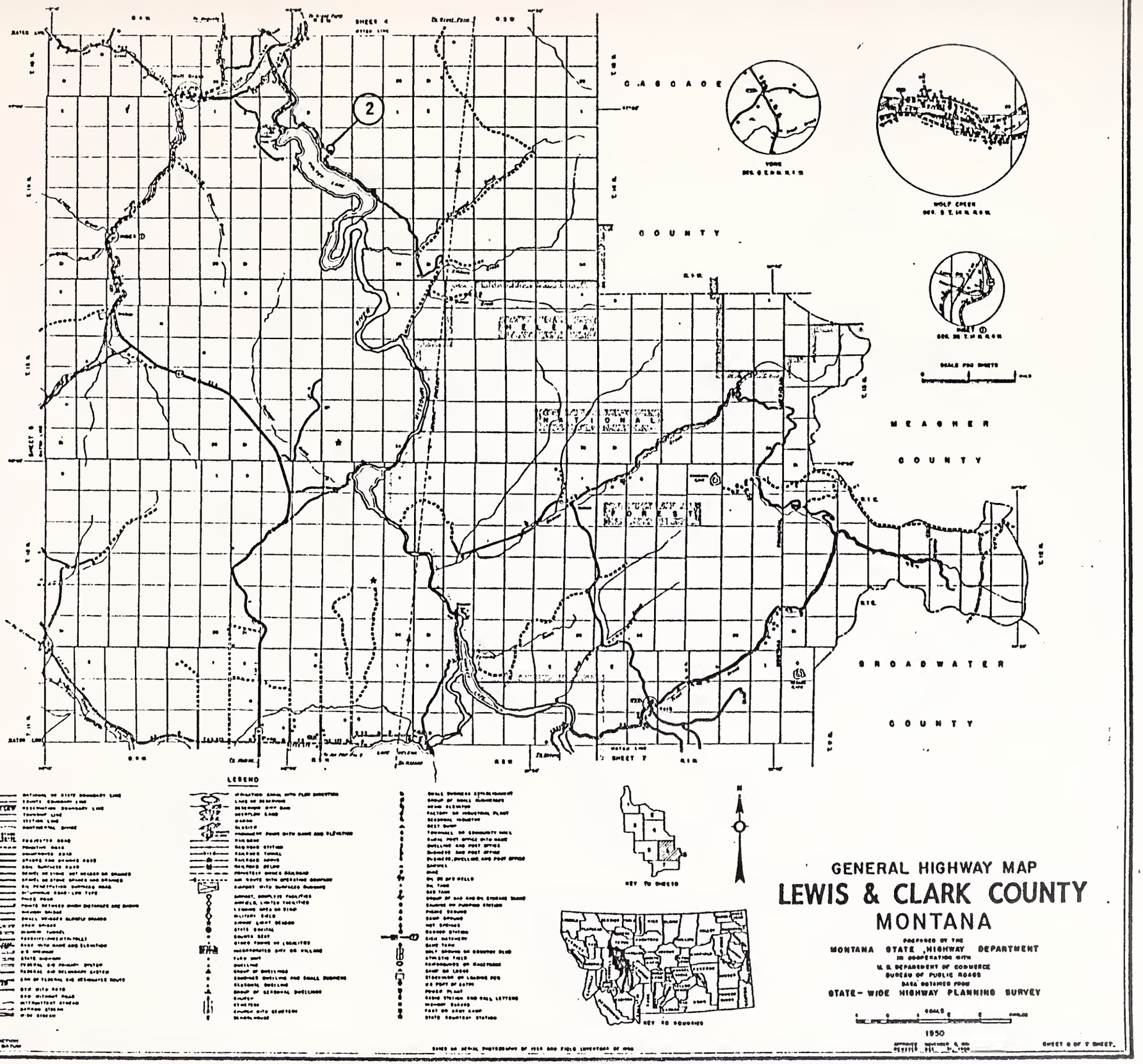
PREPARED BY THE
MONTANA STATE HIGHWAY DEPARTMENT
IN COOPERATION WITH
U.S. DEPARTMENT OF COMMERCE
BUREAU OF PUBLIC ROADS
DATA OBTAINED FROM
STATE-WIDE HIGHWAY PLANNING SURVEY

SCALE

1950

SHEET 6 OF 7 SHEETS

GENERAL HIGHWAY MAP LEWIS & CLARK COUNTY MONTANA


CASCADE
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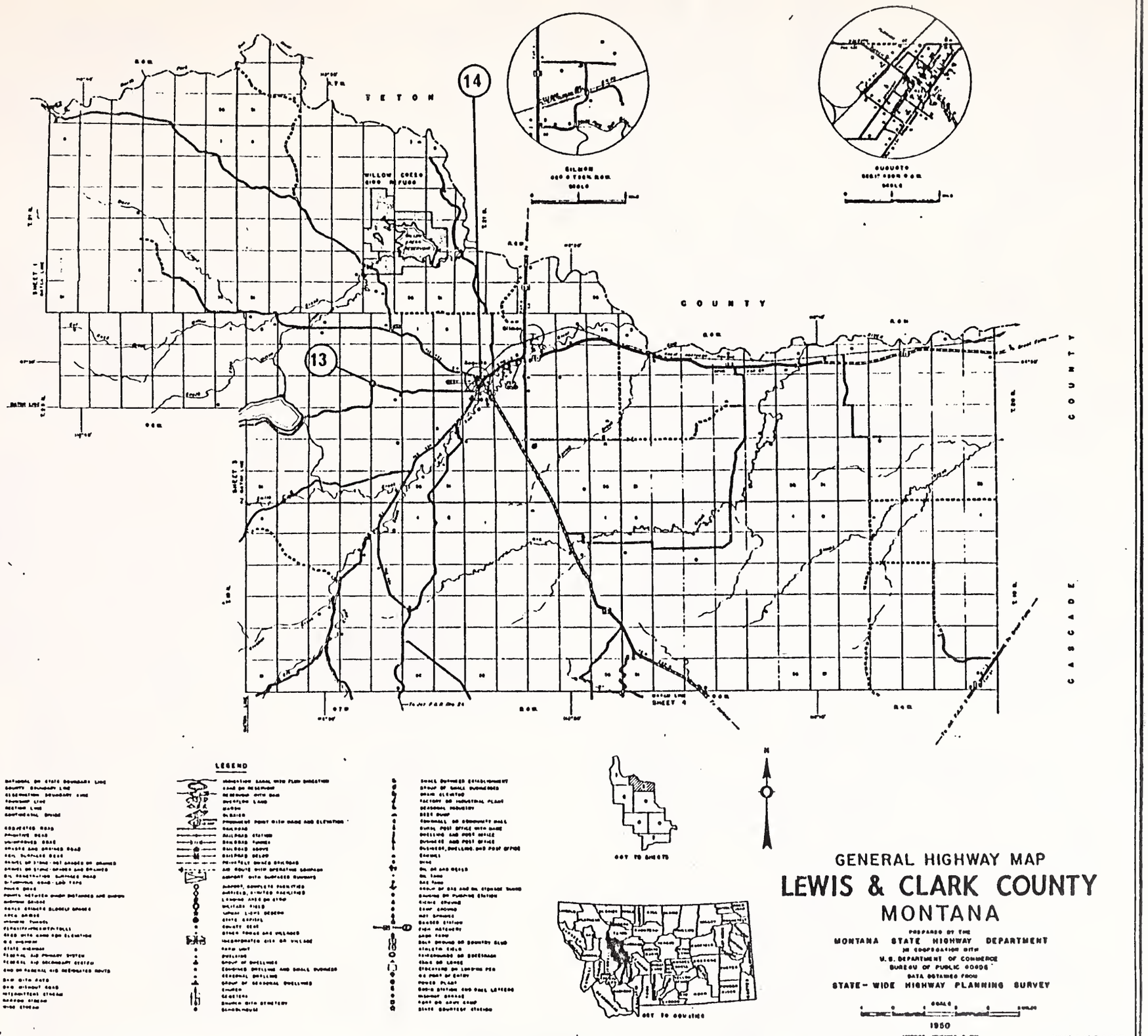
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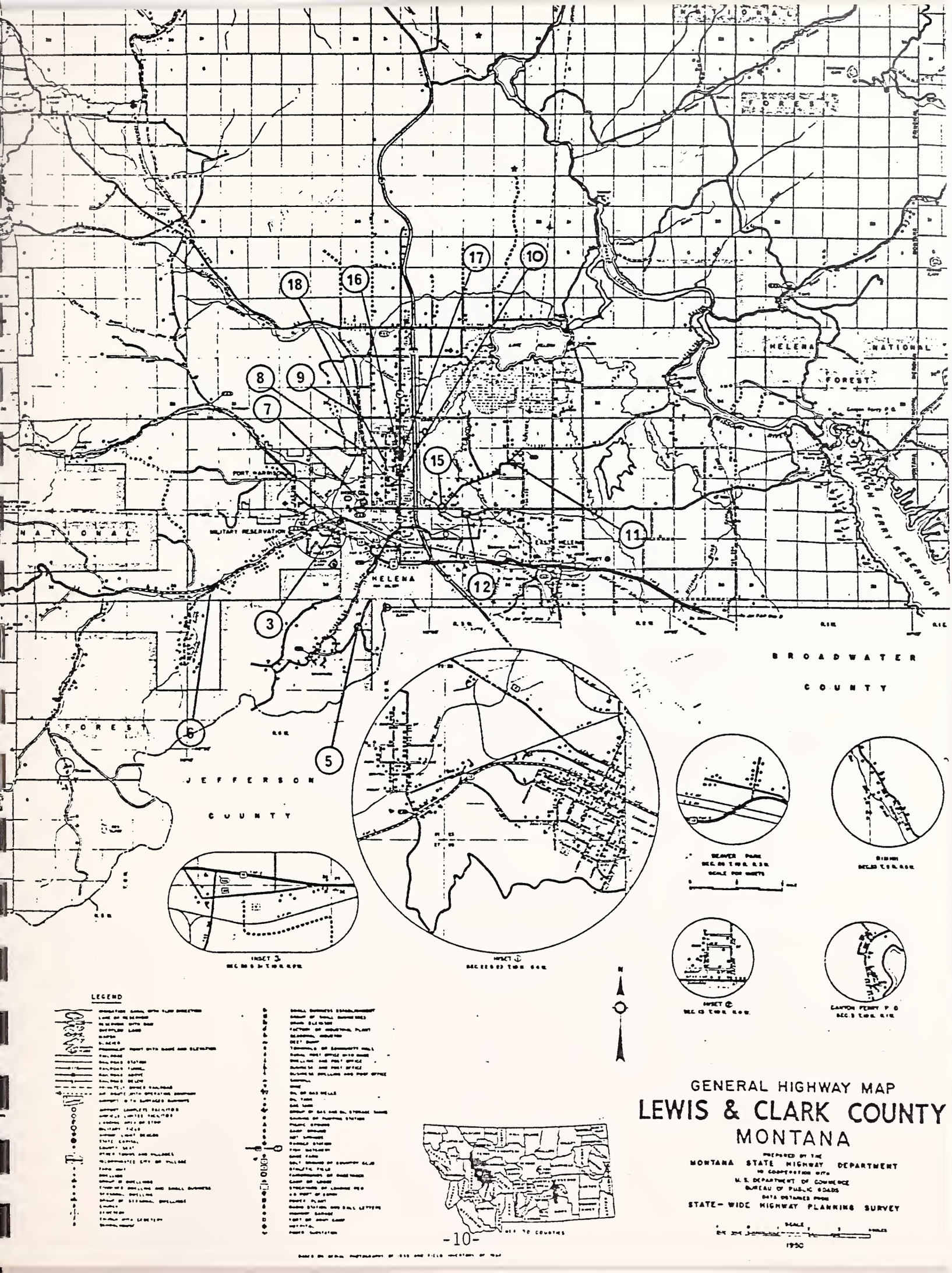
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SCALE
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HAZARD INDEX RANKING

Based on the hazard analysis for each site a matrix of indicator values and final hazard index ratings was constructed and a preliminary hazard index ranking was completed. Table 1 lists this ranking by site number, location, indicator values and hazard index. Also shown is statistical information for the indicator values and hazard index.

During the process of field data collection and subsequent indicator computations, it was discovered that the two entirely subjective indicators varied widely between consecutive analyses. Since the variation becomes great enough to drastically change the ranking, it was reviewed and the decision to eliminate those indicators from the final hazard ranking was made. This action will result in a much more manageable hazard evaluation program in the future, since Lewis and Clark County will most likely not have experienced traffic personnel available for updating the high hazard priority list.

Table 2 presents the final hazard index ranking based on the five indicator values. The relative strength of these indices is 65.2% according to the FHWA report.

TABLE 1

PRELIMINARY HAZARD INDEX RANKING

(7 Indicators - 88.6% Strength)

RANK		SITE	INDICATOR VALUES NO. ACCIDENTS	ACCIDENT RATE	SEVERITY	VOL./CAP.	SIGHT DISTANCE	DRIVER EXPECT.	INFO. DEFICIENT	HAZARD INDEX
1	#13	Nilan Reservoir Road	4	100	84	13	33	94	94	67.50
2	#5	Dry Gulch	24	100	65	23	57	75	100	67.47
3	#2	Holter Lake	33	100	66	21	28	66	100	65.60
4	#4	Bean Lake	23	100	67	19	40	66	80	62.37
5	#8	Green Meadow (Mill)	39	72	66	27	54	75	77	61.42
6	#6	Colorado Gulch	23	100	73	31	39	50	72	61.33
7	#1	Craig	24	100	65	17	11	63	75	59.04
8	#3	Country Club Drive	36	42	50	27	100	86	100	58.86
9	#15	York Road-Canyon Ferry	48	56	67	32	24	75	77	57.66
10	#11	Herrin Road	23	88	55	39	0	66	83	56.64
11	#18	McHugh Drive	24	80	64	21	0	50	50	50.73
12	#14	Augusta	14	100	45	17	35	44	33	47.81
13	#10	Buffalo Road	22	75	40	15	22	50	61	45.43
14	#9	Green Meadow Dr.(Sierra)	24	49	62	21	52	43	47	44.18
15	#7	Green Meadow Dr.(Custer)	33	46	57	26	20	51	55	44.16
16	#17	Motsiff & Mt. Ave.	33	19	64	43	0	64	61	41.99
17	#16	Mill Road & Mt. Avenue	33	18	50	46	0	64	67	40.02
18	#12	Canyon Ferry Road	24	36	68	31	11	42	42	39.44
		Average Value	26.89	71.17	61.56	26.06	29.22	62.44	70.78	53.98
		Range	4-48	18-100	40-84	13-46	0-100	42-94	33-100	39.44 67.50
		Standard Deviation	9.78	29.89	10.52	9.49	25.92	14.95	20.49	9.74

TABLE 2

FINAL HAZARD INDEX RANKING

(5 Indicators - 65.2% Strength)

RANK	SITE		INDICATOR VALUES NO. OF ACCIDENTS	ACCIDENT RATE	SEVERITY	VOL./CAP. RATIO	SIGHT DISTANCE	HAZARD INDEX
1	#6	Colorado Gulch	23	100	73	31	39	74.71
2	#2	Holter Lake	33	100	66	21	28	73.61
3	#13	Nilan Reservoir Road	4	100	84	13	33	71.73
4	#4	Bean Lake	23	100	67	19	40	71.73
5	#8	Green Meadow Drive (Mill)	39	72	66	27	54	68.85
6	#1	Craig	24	100	65	17	11	67.90
7	#5	Dry Gulch Road	24	100	65	23	57	64.68
8	#15	York Road-Canyon Ferry	48	56	67	32	24	62.92
9	#11	Herrin Road	23	88	55	39	0	62.21
10	#18	McHugh Drive	24	80	64	21	0	61.53
11	#3	Country Club Drive	36	42	50	27	100	60.90
12	#14	Augusta	14	100	45	17	35	60.90
13	#9	Green Meadow Drive (Sierra)	24	49	62	21	52	52.32
14	#7	Green Meadow Drive (Custer)	33	46	57	26	20	49.33
15	#10	Buffalo Road	22	75	40	15	22	49.12
16	#12	Canyon Ferry Road	24	36	68	31	11	46.70
17	#17	Motsiff & Mt. Avenue	33	19	64	43	0	43.38
18	#16	Mill & Mt. Avenue	33	18	50	46	0	38.06
							Average Value	60.03
							Range	38.06 - 74.71
							Standard Deviation	11.07

PRIORITY INDEX

Table 3 represents the tabular computation method used to develop the composite hazard index - cost-benefit index values. From this computation the final priority list was developed (Table 4).

It should be noted that the priority list contains only short term improvements. Since all long term improvements are major reconstruction projects based on future conditions of volume and use, a separate priority listing for long term improvements was assembled. Priorities rankings from the long term improvements list may be inserted into the short term improvements if Lewis and Clark County determines that the magnitude of funds necessary for their implementation are available. Table 5 presents the long term improvements priority list.

TABLE 3

PRIORITY INDEX COMPUTATION

HAZARD INDEX RANK	HAZARD INDEX	C/B RATIO	C/B INDEX	PRIORITY INDEX (.652 HI + .348 CB)	PRIORITY RANK	PRIORITY SITE
1	74.71	.0139	93	81.07	1	6
2	73.61	.0518	64	70.27	4	2
3	71.73	.0365	72	71.82	3	13
4	71.73	.0142	92	78.78	2	4
5	68.85	.0764	56	64.38	9	8
6	67.90	.0533	64	66.54	6	1
7	64.68	.0335	74	67.92	5	5
8	62.92	.0535	64	63.30	10	15
9	62.21	.0417	69	64.57	8	11
10	61.53	.4501	17	46.03	16	18
11	60.90	.2429	30	50.15	14	3
12	60.90	.0355	72	64.76	7	14
13	52.32	.0468	67	57.43	12	9
14	49.33	.1676	39	45.74	17	7
15	49.12	.1339	44	47.34	15	10
16	46.70	.0156	91	62.12	11	12
17	43.38	.0316	75	54.38	13	17
18	38.06	.0907	52	42.91	18	16

TABLE 4

PRIORITY LIST

(Short Term Improvements)

PRIORITY	SITE		PRIORITY INDEX	ESTIMATED COST
1	#6	Colorado Gulch	81.07	$ 528
2	#4	Bean Lake	78.78	555
3	#13	Nilan Reservoir Road	71.82	686
4	#2	Holter Lake	70.27	1,220
5	#5	Dry Gulch Road	67.92	1,365
6	#1	Craig	66.54	1,412
7	#14	Augusta	64.76	348
8	#11	Herrin Road	64.57	485
9	#8	Greenmeadow (Mill)	64.38	2,365
10	#15	York Road - Canyon Ferry	63.30	3,509
11	#12	Canyon Ferry Road	62.12	686
12	#9	Greenmeadow (Sierra)	57.43	743
13	#17	Motsiff and Montana Avenue	54.38	1,000
14	#3	Country Club Drive	50.15	7,827
15	#10	Buffalo Road	47.34	1,046
16	#18	McHugh Drive	46.03	3,082
17	#7	Greenmeadow Drive (Custer)	45.74	1,299
18	#16	Mill and Montana Avenue	42.91	1,480
		TOTAL COST SHORT TERM IMPROVEMENTS		$29,636

TABLE 5

PRIORITY LIST

(Long Term Imrpovements)

PRIORITY		SITE	PRIORITY INDEX	ESTIMATED COST
1	#5	Dry Gulch Road	55.13	$ 51,000
2	#6	Colorado Gulch	48.34	235,136
3	#8	Greenmeadow (Mill)	45.61	276,000
4	#15	York Road - Canyon Ferry	43.16	379,200
5	#12	Canyon Ferry Road	Not Justified Cost-Benefit Ratio = 1.13	
		TOTAL COST LONG TERM IMPROVEMENTS		$941,336

IMPLEMENTATION

The priority lists have been arranged in a manner that budget considerations can readily be applied in the decision to proceed with improvements. The priority ranking should be the major consideration in selecting which sites will be receiving funds first. However, when limited funds are available it may be wise to skip over one or two projects to improve a greater number of sites.

As an example, Lewis and Clark County may budget $5,500 the first year. It would be logical to proceed through the priority list totaling project costs. By the time priority Site 5 was included, the total would be $4,354. If priority Site 6 were added the total would exceed the budget by $266. Rather than under spend the budget, priority Site 6 could be skipped and priority Sites 7 and 8 could be completed that year. The following year, priority Site 6 would become priority Site 1 and the same budget procedure used to work through the list.

PROGRAM CONTINUATION

Since the basic format of the study has been outlined and an initial priority list established, continuance of the program is strongly advised. The findings and recommendations of this study will soon become obsolete without continued updating at least on an annual basis.

The following recommendations in the continuance of the program are offered to Lewis and Clark County:

1. The Highway Patrol and Sheriff's office should be accessed for copies of accident reports on a continuing basis.

2. One person should be assessed with the responsibility of the program to insure that all data is being supplied, processed and filed.

3. An accident cluster map should be maintained.

4. Develop criteria for the inclusion of additional sites to be analyzed.

5. Coordinate any traffic counting programs that may exist or establish a counting program.

6. Analyze new sites according to the procedures of this study and include them in the priority list when warranted.